Space Weather Technical Forecast

Issued on Sunday, 20 March 2022 at 00:25 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor geomagnetic storms on Day 1 (20 March).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar Activity has been Low over the past 24 hours, with one minor C-class flare originating from AR2965 in the northwest quadrant. There are currently two numbered sunspot regions on the visible, the aforementioned AR2965, which remains the largest, although the magnetic complexity continues to reduce and it has shown some fading of the trailing spot. New region AR2972 in the southeast is a Cro/Beta. The three unnumbered regions are all weak and stable but will be monitored for growth as they cross the disk.

No Earth-directed CMEs were observed on available imagery.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by DSCOVR at L1, remained at background levels ending the period near 300 km/s. Density was at average levels before increasing above average late in the period. The IMF, Bt, was weak for much of the period before increasing to around 8 nT. The north-south component, Bz, was weak and ranged between +5/-7 nT. Phi angle was mostly negative (towards the Sun). Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) measured at GOES 16 was at background. The high energy electron flux (greater than 2 MeV) has been at generally moderate levels, peaking at 327 pfu at 19/1945 UTC. The 24-hour integrated electron fluence was well below the Active (1e8 integrated pfu) threshold, with a steady trend. Observed fluence at 19/2359 UTC was 5.97e6 integrated pfu.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be at mostly Low or Very Low levels with an ongoing slight chance of an isolated M-class flare, mainly from AR2965 in the northwest. This chance reduces on Day 2 (21 March) as AR2965 rotates off the west limb.

Solar Wind / Geomagnetic Activity: Solar winds are currently at background levels, they are expected to increase on day 1 (20 March) due to either a CME from the 16th March or a High Speed Stream from CH66/-. Speeds around 500 km/s are possible.

Geomagnetic activity is expected to be mostly Quiet to Unsettled (Kp 2-3) to start. The CME arrival and/or HSS arrival will give an increased likelihood of Active (Kp 4) intervals, and a chance of G1/Minor (Kp 5) geomagnetic storms, mainly on Day 1 (20 March). During days 2 to 4 (21st-23rd) geomagnetic activity is expected to return to mainly Quiet.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain predominantly at background levels. The high energy (greater than 2 MeV) electron flux is currently at predominantly moderate levels. Further enhancement in the near term is unlikely. A combination of a possible CME and HSS arrival on Day 1 (20 March) is likely to keep flux levels suppressed at that time. A rise is then possible from Day 2 (21 March), with a rise also possible in the associated fluence level at this time, although this is low confidence due to uncertainty in the CME/HSS forecast. Fluence levels are expected to remain below 1e8 integrated pfu Active level.

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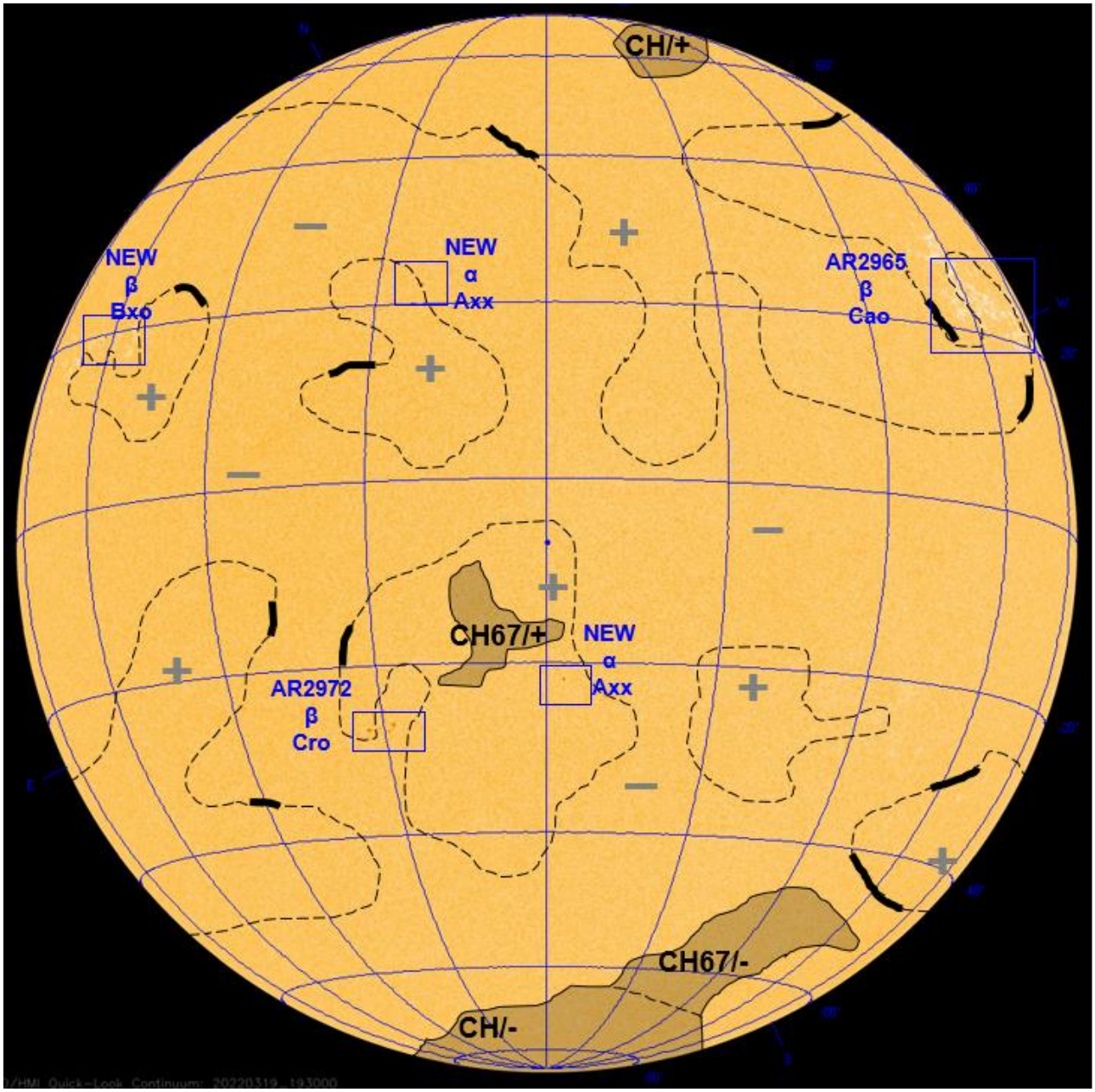
Figure 1. Solar Analysis Valid 19/2000 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Solar winds are currently at background levels, near 300km/s. They are expected to rise on Day 1 (20 March), perhaps to around 500 km/s, due to the CME from a filament eruption which occurred in the northeast around 16/1230 UTC which may give a glancing blow early on Day 1 (20th March). Also, a possible coronal hole high speed stream may arrive during Day 1 from CH66/-, a northern extension of the southern polar crown coronal hole. However, confidence is low regarding this feature as there are differences from the previous rotation. No wind speed increase has yet been detected at STEREO-A.

Geomagnetic activity is expected to be mostly Quiet to Unsettled (Kp 2-3) to start. The CME arrival and/or HSS arrival will give an increased likelihood of Active (Kp 4) intervals, and a chance of G1/Minor (Kp 5) geomagnetic storms on Day 1 (20 March). From days 2 to 4 (21st-23rd) geomagnetic activity is expected to return to predominantly Quiet.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	10	5	5
Strong	G3	No	2	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
16/1902UTC	Partial	Filament eruption	NE quadrant	580km/s	20/0600UTC	Glancing blow

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Radio Blackouts - X-Ray Flares:

Solar Activity has been Low in the past 24 hours, with only one minor C-class flare (C1.2) originating from AR2965 in the northwest. AR2965 (Cao/Beta) in the northwest quadrant remains the largest region. It has however shown decay in its trailing spot with the penumbra fading, and a simplification of its magnetic structure. New region AR2972 has developed into a Cro/Beta. There are three new and currently un-numbered sunspots which have recently emerged. These are all small and simple groups.
STEREO-A imagery shows possible returning regions which may rotate onto the east limb over the next few days.
Solar activity is forecast to continue mostly Very Low or Low with a slight chance of isolated M-class flares, with AR2965 the likely source. However, AR2965 is expected to rotate off the west limb during Day 2 (21 March) so the probability of M-flares will start to reduce at that point.

X Ray Flares / Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	5	5	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (10MeV) measured at GOES-16 is currently at background levels, and is expected to remain at this level.

Radiation Storms / Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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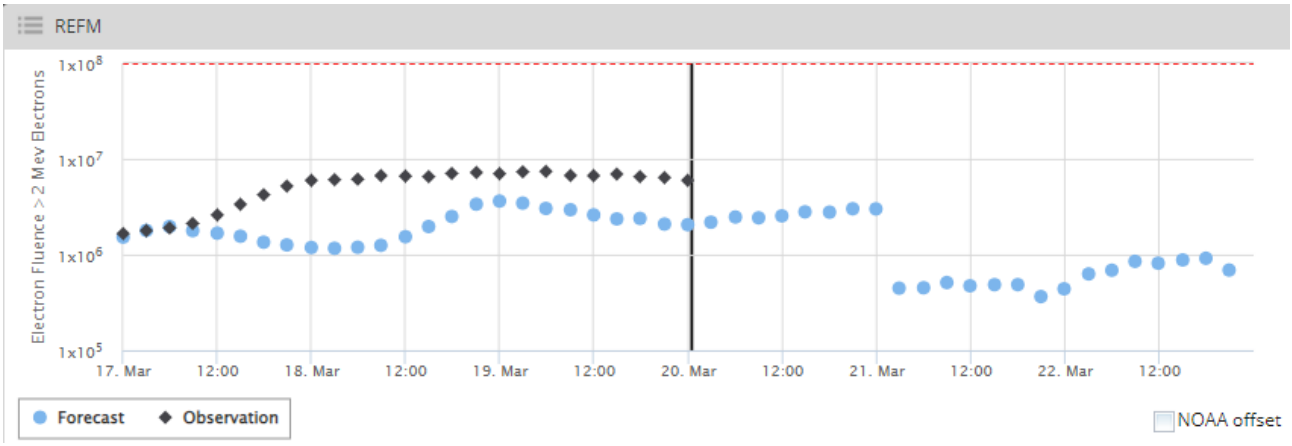
High Energy Electrons Event (≥ 2MeV):
The high energy (greater than 2 MeV) electron flux as observed at GEO by GOES-16 is currently at predominantly moderate levels. Further enhancement in the near term is unlikely, with no recent significant wind speed enhancements which would have caused charging. A combination of a possible CME and HSS arrival on Day 1 (20 March) is likely to keep flux levels suppressed at that time. A rise is then possible on Days 2-4 (21-23 March) if the wind speed does increase, once any geomagnetic effects wane.
The associated fluence is expected to stay well below the Active (1e8 integrated pfu) threshold for much of the period. A rise is possible on Day 3 or 4 (22-23 March), although this is low confidence due to uncertainty in the CME/HSS forecast. REFM is currently underestimating the fluence level - it is probably providing reasonable guidance until Day 3 (22 March) however.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	10	20	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 2: MOSWOC REF Model forecasting fluence levels well below 1e8 integrated pfu Active level.



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